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(54) Data transmitting and receiving apparatus and method for a digital mobile station

(57) Disclosed is an apparatus and method of transmitting and receiving storage data for a digital mobile station, and more particularly a data transmitting and receiving apparatus and method capable of transmitting and receiving a large capacity of data using a short message service. According to the data transmitting method, stored data is read and encoded in a data transmission mode, and inherent distinction data transmission headers are generated according to completion of the data encoding. the encoded data and the generated data transmission headers are formed into user data of a short message service, and short message service blocks including the user data of the short message service are transmitted.

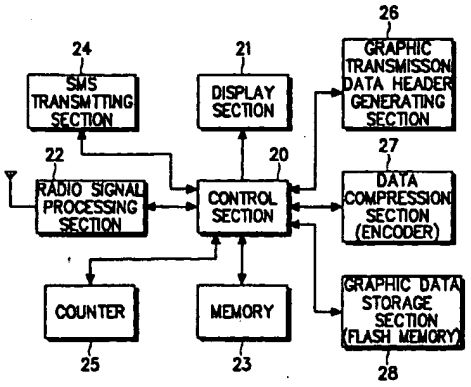

FIG. 2

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Description

[0001] The present invention relates to an apparatus and method of transmitting and receiving storage data for a digital mobile station, and more particularly to a data transmitting and receiving apparatus and method which can transmit and receive a large capacity of data using a short message service.

[0002] Typically, a user of a digital mobile terminal can make a sentence into blocks in accordance with a short message service (SMS) specification whose internal construction is standardized using the SMS additionally implemented in the mobile station and transmit the blocks to an opposite party. In order to effect the SMS, a message sending function for preparing, editing, and sending the sentence should be implemented in the mobile station itself under the support of a digital mobile station system to which the mobile station belongs.

[0003] FIG. 1 shows the construction of the whole mobile station system where the SMS is performed. Referring to FIG. 1, if the user of a mobile station (MS) 10 prepares a sentence and then inputs the phone number of the opposite party and the send key, the prepared sentence is constructed as blocks, and then transmitted to a base station (BS) 12 and to a mobile switching center (MSC) connected to the base station 12 through an extra pilot channel as a radio signal. The transmitted SMS blocks are then transferred to a mobile terminal or a terminal equipment (TE) 16, which corresponds to the inputted phone number, through a radio network or a public switched telephone network (PSTN) 14, and the opposite party ascertains the transmitted character message through decoding of user data included in the transmitted SMS blocks.

[0004] The performance of the SMS in the digital mobile station enables mutual transmission/reception of the sentence of a predetermined size in addition to the telephone function, and thus improves the user convenience. In other words, the user can separately prepare the sentence, and transmit the sentence to the desired opposite party as the radio signal.

[0005] However, the conventional SMS has the drawbacks in that the mutual data transmission/reception is possible only for the sentence of a specified length, that is, of a specified amount of data determined by the system, and thus the radio data transmission can be effected only for the sentence composed of text characters having a relatively small amount of data. Specifically, the data capacity of the SMS block is determined by the system provider, and thus diverse types of data transmission cannot be effected using the SMS. In other words, graphic data or audio data having a large amount of data relative to the sentence composed of the characters cannot be transmitted through the SMS. As a result, the convention digital mobile station can transmit and receive a relatively small amount of data through the SMS, but cannot transmit and receive a relatively large amount of data such as graphic data. Accordingly, in order to transmit a large amount of data, a new system should be provided. Also, the conventional digital mobile station has the disadvantages that the data transmission between the mobile terminals cannot be effected, and the use of another function is limited during the performance of the data service.

[0006] As described above, according to the SMS of the conventional digital mobile station, the user can only prepare and transmit the sentence of a limited length since the size of the data, which can be included in the SMS block, is limited. This forces the user to prepare the sentence of the limited length in transmitting the sentence through the SMS. If the user intends to prepare and transmit the sentence having the amount of data larger than that which can be included in the SMS block, he or she must divide the sentence to be transmitted into several sub-sentences, and then separately prepare and transmit the respective sub-sentences, causing the user inconvenience in use. This means that the transmission of the data having a large amount of data is actually impossible.

[0007] Consequently, the conventional digital mobile station has the problems that the user cannot widely use the SMS due to the limited condition of the SMS in transmitting data, but can only transmit and receive a simple message mutually.

[0008] Accordingly, the present invention has been made in an effort to solve the problems occurring in the related art, and the object of the present invention is to provide a data transmitting and receiving apparatus and method for a digital mobile terminal which can transmit and receive a relatively large amount of data using a short message service. That is, the present invention provides an apparatus and method which can perform the mutual transmission and reception of a large amount of data between the originating and terminating parties using the typical SMS without constructing a separate device or system for the transmission and reception of a large amount of data.

[0009] The object of the present invention is solved by the subject matters of the independent claims.

[0010] Preferred embodiments are the subject matter of the dependent claims.

[0011] According to an aspect of the present invention, there is provided a data transmitting method for a digital mobile station comprising the steps of reading and encoding stored data in a data transmission mode, generating inherent distinction data transmission headers according to completion of the data encoding, forming the encoded data and the generated data transmission headers into user data of a short message service, and transmitting short message service blocks including the user data of the short message service.

[0012] According to another aspect of the present invention, there is provided a data receiving method for a digital mobile station comprising the steps of detecting whether short message service blocks are received, if it

is detected that the short message service blocks are received, detecting whether the detected blocks include predetermined inherent distinction data transmission headers, if it is detected that the data transmission headers are included, analysing the headers and decoding the received short message service blocks according to a result of analysis, and storing the decoded short message service blocks in succession to previously processed short message service blocks.

[0013] According to still another aspect of the present invention, there is provided a method of constructing short message service blocks for a digital mobile station, comprising the steps of dividing encoded data into blocks of a predetermined unit, generating inherent data transmission headers corresponding to the respective divided blocks and adding the generated headers to the divided blocks, and adding short message service headers to the blocks to which the transmission headers are added, respectively.

[0014] According to still another aspect of the present invention, there is provided a short message service data block structure comprising a short message service header region, a transmitted data distinction region, a region for a whole number of blocks of encoded data, a region for a transmission order of the encoded data, a transmitting part distinction region, a region for distinction of a kind of the transmitted data, and a transmitted data region.

[0015] In a preferred embodiment of the present invention, short message service blocks for a digital mobile station are constructed by means of dividing encoded data into blocks of a predetermined unit, generating inherent data transmission headers corresponding to the respective divided blocks and adding the generated headers to the divided blocks, respectively and adding short message service headers to the blocks to which the transmission headers are added, respectively

[0016] In another embodiment, the short message service block construction may further comprise the step of generating and adding to the divided block a block termination code for indicating a final data of the block.

[0017] In still another embodiment, the generated inherent data transmission header from a short message service block may comprise a transmitted data distinction field including a transmitted data distinction code, a field for a whole number of blocks, a transmission order field, a transmitting part distinction field, and a field for distinction of a kind of the transmitted data.

[0018] In still another embodiment, the generated inherent data transmission header from a short message service block may further comprise a coding type distinction field for indicating an encoding type.

[0019] In still another embodiment, the generated inherent data transmission header from a short message service block may further comprise an extension field applied and used according to intent of a service provider.

[0020] In another preferred embodiment, a short message service data block structure comprises a user data field region which includes a short message service header field including a short message service header, a data header field for distinction of transmitted data, and a transmitted data field including encoded transmitted data.

[0021] In another embodiment, the data header field of a short message service data block structure comprises a transmitted data distinction field, a field for a whole number of blocks of the encoded data, a field for a transmission order of the encoded data, a transmitting part distinction field, a distinction field of a kind of the transmitted data, and a transmitted data field.

[0022] In still another embodiment, the data header field of a short message service data block structure further comprises an encoding type distinction field.

[0023] In still another embodiment, a short message service data block structure further comprises a block termination distinction field for distinction of a termination of the block.

[0024] In still another embodiment, wherein the transmitted data distinction field from a short message service data block structure is composed of 2 bytes, the field for the whole number of blocks of the encoded data is composed of 4 bits, the field for the transmission order of the encoded data is composed of 4 bits, the transmitting part distinction field is composed of 4 bytes, the distinction field of the kind of the transmitted data is composed of 2 bytes, the transmitted data field is composed of predetermined bytes set by a system, the encoding type distinction field is composed of 6 bits, and the block termination distinction field is composed of 6 bits.

[0025] In still another preferred embodiment of the present invention, a short message service block transmitting and receiving apparatus for a digital mobile station comprises a short message service block transmitting and receiving section for transmitting and receiving short message service blocks; a transmitted data storage section for storing the transmitted and received short message service blocks; a data coding section for encoding the transmitted data and dividing the encoded data into blocks of a predetermined unit, the data coding section sequentially decoding the blocks sequentially received in a predetermined order; a header generating section for generating inherent transmission headers to be added to the respective blocks; a transmission header detecting and analyzing section for detecting and analyzing the inherent transmission headers included in the received short message service blocks; and a control section for designating a storage order of the decoded blocks according to a result of analyzing the detected transmission headers, adding short message service headers to the respective blocks to which the transmission headers are added, and transmitting the blocks including the transmission head-

ers and the short message service headers added thereto.

[0026] In another embodiment, the short message service block transmitting and receiving apparatus further comprises a display section for displaying a state of the short message service transmitted and received according to the result of analyzing the detected transmission headers.

[0027] The above objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 is a block diagram illustrating the construction of a conventional digital mobile station system for performing a short message service;
FIG. 2 is a block diagram illustrating the construction of a data transmitting apparatus for a digital mobile station according to a preferred embodiment of the present invention;
FIG. 3 is a block diagram illustrating the construction of a data receiving apparatus for a digital mobile station according to a preferred embodiment of the present invention;
FIG. 4 is a view illustrating the data structure of a short message service block transmitted and processed according to a preferred embodiment of the present invention;
FIG. 5 is a flowchart illustrating a data transmitting method for a digital mobile station using a short message service according to a preferred embodiment of the present invention;
FIGs. 6A and 6B are a flowchart illustrating an encoding method of the data to be transmitted by the method of FIG. 5;
FIG. 7 is a view illustrating a data receiving method for a digital mobile station using a short message service according to a preferred embodiment of the present invention;
FIGs. 8A and 8B are flowcharts illustrating a transmitted data decoding method in FIG. 7; and
FIG. 9A and 9B are views illustrating the display state of a digital mobile terminal according to a preferred embodiment of the present invention.

[0028] Reference will now be made in greater detail to the preferred embodiments of the present invention. In the drawings, the same or similar elements are denoted by the same reference numerals even though they are depicted in different drawings. In the following description of the present invention, many specified items such as detailed circuit elements are indicated, but they are provided only for the whole understanding of the present invention and thus it will be understood by those skilled in the art that the present invention can be performed without such specified items. Meanwhile, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear. Especially, the essential elements of the typical mobile station such as a dual tone multi-frequency (DTMF) section, a vocoder, etc., are not directly related to the subject matter of the present invention, and detailed explanation thereof will be omitted. However, such construction should be essentially provided in performing the present invention.

[0029] In explaining the preferred embodiment of the present invention with reference to the accompanying drawings, graphic data will be taken as an example of the data transmitted and received through the SMS. This is because the graphic data has a relatively large amount of data in comparison to character data, and thus it is judged that taking the graphic data as an example is preferable in explaining the preferred embodiment of the present invention. However, it should be noted that the performance of the present invention would be normally effected even though the graphic data is replaced by any other type data.

[0030] FIG. 2 is a block diagram illustrating the construction of a data transmitting apparatus for a digital mobile station using the SMS according to a preferred embodiment of the present invention.

[0031] Referring to FIG. 2, a control section 20 controls the whole operation of the digital mobile station, and the whole performance of a short message service according to the present invention. The control section 20 is typically implemented by a one-chip microprocessor. In the embodiment of the present invention, the control section 20 controls compression of the graphic data, production of the SMS block, generation of a graphic transmission data header, readout of the stored graphic data, and operation of a bit counter

[0032] A memory 23 includes a volatile memory (for example, RAM) and a nonvolatile memory (for example, flash memory or EEPROM), and performs the storage of a program for controlling the whole operation of the digital mobile station, the storage of initial service data, and the storage of an operation program for performance of the short message service and data produced according to the performance of the operation program. The memory also performs a buffer function for storing input and output data.

[0033] A display section 21 is a user interface device for displaying the whole state of the digital mobile station and input numerals and characters, and is typically implemented by a liquid crystal display (LCD) driven under the control of the control section 20. In the embodiment of the present invention, the display section 21 displays the transmission state of data transmitted under the control of the control section 20 in a specified form, so that the user can visually identify the data transmission state.

[0034] A radio signal processing section 22 performs the whole processing of the radio signal transmission and reception between the digital mobile station and the base station to which the digital mobile station

belongs. Specifically, the radio signal processing section 22 converts an input audio signal of a radio frequency band to an intermediate frequency (IF) signal, converts the IF signal to a baseband signal, and then converts the baseband signal to a digital signal. Also, in sending the audio signal, the radio signal processing section 22 performs an operation opposite to that described above. Meanwhile, a radio data transmission is performed by the radio signal processing section 22. That is, in the embodiment of the present invention, the produced SMS blocks are radio-transmitted under the operation of the radio signal processing section 22.

[0035] An SMS transmitting section 24 makes the prepared sentence and data into the SMS blocks. In making the data into the SMS blocks by the SMS transmitting section 24, the contents of the block are conformable to a standardized format. A typical format includes an SMS header field and an SMS user data field in constructing the SMS block. The SMS header field follows a determined rule, and the system provider properly determines the size of the SMS user data field. Korean digital mobile station system providers determine the size of the SMS user data field to be 100 bytes or so, and this means that the sentence to be transmitted should be prepared as data of 100 bytes or so. Adding the SMS header to the prepared SMS user data field produces the SMS block by the SMS transmitting section 24. The produced SMS block is then transferred to the radio signal processing section 22 to effect the radio data transmission.

[0036] A graphic data storage section 28 stores the produced graphic data in a specified form. Specifically, the graphic data is stored in the form of bit streams having respective addresses, and thus the storage regions thereof are different according to the kinds of the graphic data. The data storage capacity is variably determined according to the storage capacity of the memory.

[0037] A data compression section 27 is additionally provided according to the embodiment of the present invention, and compresses the data prepared or read out to be transmitted. The data compression section 2 is typically called an encoder that compresses the data to be transmitted by a predetermined compression method. In transmitting the graphic data through the SMS, the data compression section 27 compresses the graphic data having a relatively large amount of data into data having a small amount of data without loss. According to the present invention, a data compression method based on a run length coding (RLC) method is implemented so that the compressed data is included in the SMS block. This is to be conformable to the fact that the graphic data expressed in the typical mobile station is composed of two components of black and white. As a result, the data compression section 27 is implemented to compress the transmitted data according to the RLC method.

[0038] A graphic transmission data header generating section 26 generates an inherent distinction header for recognizing that the data compressed and then transmitted is the graphic data. In the present invention, the generated distinction header is called data transmission header, and is included in the SMS user data field of the SMS block. The format of the data transmission header generated according to the embodiment of the present invention will be explained hereinafter with reference to FIG. 4.

[0039] A counter 25 increases a specified variable according to the readout of the bits of the graphic data that is read out in the form of bit streams. This variable is defined as a counted value of bits, and increases for the readout of one bit. Accordingly, the graphic data having a relatively large amount of data can be transmitted after being compressed and made into the SMS blocks by the data transmitting apparatus of FIG. 2. In the event that the amount of the compressed graphic data exceeds the data size which cannot be included in one SMS block, the data compression section 27 and the control section 20 process to produce another SMS block so as to transmit the large amount of data. That is, in the embodiment of the present invention, a plurality of SMS blocks are produced and transmitted if needed during the SMS transmission of the graphic data.

[0040] FIG. 3 is a block diagram illustrating the construction of a data receiving apparatus for a digital mobile station using the SMS according to a preferred embodiment of the present invention.

[0041] Referring to FIG. 3, a control section 30 controls the whole operation of the digital mobile station, and the whole performance of a short message service according to the present invention in a similar manner to the control section of the data transmitting apparatus of FIG. 2. The control section 30 is typically implemented by a one-chip microprocessor. In the embodiment of the present invention, the control section 30 controls decompression of the compressed graphic data included in the received SMS block, analysis and process of the graphic transmission data header, and storage of the decompressed graphic data.

[0042] A memory 33 includes a volatile memory and a non-volatile memory, and performs the storage of a program for controlling the whole operation of the data receiving apparatus of the digital mobile station, the storage of initial service data, and the storage of an operation program for performance of the short message service and data produced according to the performance of the operation program according to the embodiment of the present invention. The memory also performs a buffer function for storing input and output data.

[0043] A display section 31 serves as a user interface device for displaying the whole state of the digital mobile station and input numerals and characters. In the embodiment of the present invention, the display section 31 displays the reception state of the data received under the control of the control section 30 in a

specified form, so that the user can visually identify the data reception state.

[0044] A radio signal processing section 32 performs the same operation as the radio signal processing section 22 of the data transmitting apparatus. The radio processing section 32 processes the SMS block additionally received, and transfers the processed SMS block to the control section 30.

[0045] A graphic data storage section 38 stores the graphic data, which has been received and decompressed in a specified form. Specifically, the graphic data is stored in the form of bit streams having respective addresses. The storage regions of the graphic data are different according to the kinds of the graphic data, and the storage of the graphic data in the respective storage regions is performed in the order of the received SMS blocks. Thus, the respective SMS blocks are stored in their proper storage regions even if the received SMS blocks are in wrong order. Specifically, if a plurality of SMS blocks that correspond to the graphic data of the same kind are sequentially received, they are stored in the corresponding storage regions in their receiving order to complete the original graphic data. If the SMS blocks are received in the wrong order, they are rearranged to be stored in their proper storage regions according to the order information included in the respective SMS blocks to accurately complete the original graphic data. And, even if a plurality of SMS blocks that correspond to different kinds of the graphic data are received, they are rearranged as the blocks of the same kind and stored in their corresponding storage regions.

[0046] A graphic data storage section 38 is implemented by a flash memory typically used in the digital mobile station. A data decompression section 37 is additionally provided according to the embodiment of the present invention, and decompresses the data received and read out. The data decompression section 37 is typically called a decoder that decompresses the received data by a predetermined decompression method for the restoration of the original data. For instance, if the SMS blocks which have been compressed by and transmitted from the data transmitting apparatus as shown in FIG. 2 are received, the original data of the received SMS blocks is restored by decoding the SMS blocks according to the run length coding (RLC) method. As described above, the decoded data is stored in the specified storage regions of the graphic data storage section 38. A graphic transmission data header analyzing and processing section 36 detects and analyzes distinction headers if the distinction headers are included in the receive SMS blocks. Specifically, if the distinction header is the data transmission header having the format as shown in FIG. 4, the graphic transmission data header analyzing and processing section 36 analyzes the contents of the data transmission header, so that the control operation of the control section 30 is performed accordingly.

[0047] FIG. 4 is a view illustrating the data structure of a short message service block which is produced, transmitted, received, and analyzed by the data transmitting and receiving apparatuses as shown in FIGs. 2 and 3. Referring to FIG. 4, the structure of the SMS block according to the preferred embodiment of the present invention will be explained with the data transmission operation.

[0048] First, if the capacity of the graphic data exceeds a predetermined extent, the corresponding graphic data is reconstructed and transmitted as a plurality of SMS blocks by the data transmitting apparatus of FIG. 2. The respective SMS block is divided into an SMS header and an SMS user data field in the same manner as the typical SMS block. The SMS header is constructed in the form determined in the digital mobile terminal system. The SMS user data is divided into a graphic data transmission header field and a compressed graphic data field according to the embodiment of the present invention, whereas it includes the sentence as a coded state according to the conventional SMS.

[0049] Specifically, the graphic data transmission header is divided into fields of A, B, C, D, E, F, G, and H, and the graphic data field is divided into fields of I and J as shown in FIG. 4. The A field includes a code for discriminating that the transmitted SMS block is the SMS block according to the graphic data transmission, and is allocated with 2 bytes. The B field represents the whole number of SMS blocks that constitute one graphic data to be transmitted. The C field represents the order of the SMS blocks to be transmitted. Even though the SMS blocks may be received in wrong order, the B field identifies the order of the respective SMS block. In the embodiment of the present invention, the B and C fields are allocated with 4 bits, respectively. The D field represents a code for the distinction of the transmitting part, and the receiving part can recognize which transmitting part the graphic data is transmitted from by detecting the D field. The D field is allocated with 4 bytes. The E field represents a code for the distinction of the kinds of the graphic data, and the receiving part can recognize the kind of the received graphic data by detecting this code even if the SMS blocks according to the various kinds of graphic data is received from the same transmitting part. The F field is a field that is allocated for the extension in use, and the G code is a field representing the coding type, i.e., the type of compression. The receiving part can recognize the compression type of the transmitted data by detecting the G field. The H field is used also for extension, and the I field is a field containing actually compressed graphic data. Thus, the graphic data compressed and transmitted by the transmitting part is positioned in the I field, and this graphic data of the I field is restored to the original data by the receiving part. The graphic data subject to transmission may be composed of a plurality of blocks each of which corresponds to the size of the I field. The J field repre-

sents a block terminating code for indicating the termination of one block, and the receiving part recognizes the termination position of the corresponding SMS block by detecting the J code. In the embodiment of the present invention, the E, F, G, H, I, and J fields are allocated with 2 bytes, 3bytes, 1 byte, 1 byte, n bytes, and 6bits, respectively. The size of the I field is determined as the difference value between the size of the graphic data transmission header field and the size of the J field. Producing, transmitting, and receiving the SMS blocks as constructed above perform the present invention.

[0050] FIG. 5 is a flowchart illustrating a data transmitting method for a digital mobile station using a short message service according to a preferred embodiment of the present invention, and shows the operation of the data transmitting apparatus of FIG. 2. FIGs. 6A and 6B are a flowchart illustrating a transmitted data encoding method in FIG. 5, and shows the production of the SMS block structured as shown in FIG. 4.

[0051] Referring to FIGs. 5, 6A and 6B, the data transmitting method according to the present invention will be explained in detail.

[0052] First, if a graphic transmission mode is set by the user at step 510, the input of graphic data is performed. Specifically, the originating and terminating phone numbers are inputted at step 520, and the transmission graphic data to be transmitted is selected and read out at step 530. Then, the size of the SMS user data field is determined by the digital mobile station system at step 540. This value may be fixedly set by the SMS provider, or by the control signal exchange with the user or the base station. The operation at step 540 will be the basis of judging how many blocks constitute the graphic data in making the graphic data into the SMS blocks. For instance, if it is determined that the graphic data is of one Kbytes and the SMS user field is of 100 bytes, the graphic data should be made into at least 10 blocks, and such judgement is effected based on the operation result of step 540.

[0053] At step 550, the variable T which represents the whole number of blocks to be transmitted is initialized (T=0). At step 560, the graphic data selected and read out at step 530 is encoded according to the determined compression method and to meet the graphic data field, i.e., the I field of the SMS user data. The graphic data is converted into proper blocks by the encoding operation, and the number of the convened blocks is variably determined according to the data amount of the graphic data. At step 570, the graphic data transmission headers are generated and added to the respective produced blocks. The added graphic data transmission headers have the same structure as shown in FIG. 4, but have different contents of the transmission block order field C. The order of the respective transmitted SMS block is determined by the C field. As described above, since the graphic data is transmitted, being divided into blocks, it is required that the original graphic data should be correctly restored according to the order of the blocks. In other words, the plurality of SMS blocks are assembled to one graphic data according to the order of the C field.

[0054] At step 580, the data transmission state is displayed on a display screen, so that the user can visually recognize the data transmission state. For instance, the display of the data transmission state is performed with reference to the contents of the B field and the C field, that is, in the form of 'C/B'. In transmitting a plurality of SMS blocks corresponding to one kind of graphic data, the transmission of the first block is displayed as a '1/T' state, and the transmission of the second block is displayed as a '2/T' state. At step 590, an SMS transmitting operation is performed. Since such an SMS transmitting operation is well known in the art, and the detailed explanation thereof will be omitted. The order (I) of the SMS transmission block is increased by 1 at step 600, and it is judged whether the order (I) is equal to the total number of blocks (T) at step 610. That is, it is judged whether the SMS block of the final order among the whole SMS blocks is transmitted. If I is not equal to T, this means that the transmission of the graphic data is not completed, and the operation of step 570 is repeatedly performed. If it is judged that I is equal to T at step 610, this means that the final SMS block is transmitted or the transmission of the graphic data is completed, and thus the state of completion of the graphic data transmission is displayed at step 620 to complete the graphic data transmission through the SMS. Consequently, according to the embodiment of the present invention, the data to be transmitted is read out and encoded, and the encoded data is made into SMS blocks, and then the SMS blocks are sequentially transmitted.

[0055] Meanwhile, the encoding process of the graphic data to be transmitted at step 560 will now be explained in detail with reference to FIG. 6 which shows the encoding method based on the run length coding.

[0056] First, a bit-count value is set as '0' at step 561. The graphic data is read bit by bit and the bit-count value is increased according to the number of readout bits. At step 562, the graphic data is read out bit by bit and it is judged whether the readout bit is the final bit of the graphic data, i.e., it is judged whether the bit that corresponds to the coordinate value of the final pixel of a picture at step 563. If the final bit is not detected at step 563, the bit-count value is increased by 1 at step 564. Then, it is judged whether the detected bit is '0' or '1'. In the embodiment of the present invention, the bit '0' is designated as a white color of the graphic data, and the bit '1' as a black color of the graphic data. This follows the fact that the LCD of the typical mobile station can display only two colors of white and black. The reason why the bit '0' is designated as the white color is that the white components exist more than the black components do in the graphic data in probability. If the readout bit is '0' as a result of detection at step 564, the value of the count (C) according to the detection of '0' is

increased by 1 at step 566. This operation is for generating a run length code as a part of the compression operation according to the run length coding. If the readout bit is '1' as a result of detection at step 565, the run length coding of the counted value according to the detection of the previous bit '0' is effected at step 567, the counted value is initialized again at step 568, and then the coding of the graphic data to be transmitted is performed by adding the bit '1' detected at step 569 to a result of the run length coding. In other words, if the bit '0' is detected according to the run length coding, its detection number is counted, while if the bit '1' is detected, the bit '1' is added to the coding result of the number of '0' detection, and this result of addition is stored as the graphic data to be transmitted. The SMS provider may properly prepare a table for the coding of the detection number.

[0057] At step 571, it is judged whether the bit read out at step 565 is the final bit of the SMS block with reference to the result according to the determination of the SMS user data field. If it is judged that the bit is not the final bit of the SMS block at step 571, it means that the data coding is not completed with respect to the SMS block, and the operation of step 562 is repeated. However, if it is judged that the bit is the final bit of the SMS block, it means that the graphic data field is fully filled by the coded data to complete one SMS block, and thus the comparison of the transmitted data is performed at step 572. Specifically, the bit stream length of the coded compressed data is compared with that of the original data. This comparing operation is for selectively transmitting data having a less amount of data since the data compressed according to the run length coding may have a larger amount of data than the original data. If it is judged that the graphic data has a less amount of data at step 573, the original data is determined as the data to be included in the graphic data field at step 574, and the total number of blocks is increased at step 581. However, if it is judged that the compressed data has a less amount of data than the original data at step 573 (this judgement is performed according to the length of the bit stream of the respective data), the compressed data is determined as the data to be included in the graphic data field at step 575, and then a block termination code of 6 bits is added thereto at step 579. As described above, the block termination code serves to indicate the end of one block. Thereafter, the operation of step 581 is performed in the same manner as described above.

[0058] Meanwhile, if the final bit of the transmitted graphic data, i.e., the bit corresponding to the final pixel, is detected at step 563, it is judged whether the '0'-detection count (C) is initialized to '0' at step 576. If so, the value of '0'-detection count is coded according to the run length coding at step 578, and then steps 579, 581 to 585 are sequentially performed in the same manner as step 572, 573, 574, 575, 579, and 581, respectively. Thereafter, step 585 is performed to complete the graphic data encoding process.

[0059] FIG. 7 is a view illustrating a data receiving method for a digital mobile station using a short message service according to a preferred embodiment of the present invention, and FIGs. 8A and 8B are flowcharts illustrating a transmitted data decoding method of FIG 7 in more detail. The method illustrated in FIG. 7 is performed by the data receiving apparatus of FIG. 3.

[0060] Referring to FIGs. 7, 8A and 8B, the data receiving method for a digital mobile station according to the embodiment of the present invention will be explained in detail.

[0061] First, during a standby state of the digital mobile station at step 710, it is judged whether SMS blocks are received at step 720. If so, an SMS receiving mode is set at step 730, and it is detected whether graphic data transmission headers are included in the received SMS blocks at step 740. If it is detected that the graphic data transmission headers are included in the received SMS blocks, this means that the received blocks are not general SMS blocks, but are the blocks including compressed data. Thus, an analysis of the graphic data transmission headers is performed at step 750. Meanwhile, if the graphic data transmission headers are not detected at step 740, a general SMS block processing operation is performed at step 741. At step 750, the detection of the transmitting part distinction code (D field) (step 751), the code of the kind of the graphic data (E field)(step 752), the coding type distinction code (G field)(step 753), the total number of transmitted blocks (B field)(step 754), and the order of transmitted blocks (C field)(step 755) are sequentially performed. The kind and components of the transmitted SMS blocks can be recognized by the receiving part according to the respective detected code values.

[0062] At step 760, the receiving state of the SMS blocks is displayed with reference to the B field and the C field of the analyzed graphic data transmission header, so that the user can recognize the order of the SMS block currently received. At step 770, the received graphic data is decoded with reference to the G field. At step 780, it is judged whether the currently received SMS block is the block which follows the previously received SMS block, i.e., whether the code of the kinds of the graphic data of the currently received block is identical to that of the previously received block, If so, the graphic data decoded at step 770 is processed in connection with the graphic data of the SMS block previously processed and stored at step 790. As a result, the original graphic data is constructed by assembling the graphic data of the previous SMS block and the graphic data of the currently received SMS block. However, if it is judged that the currently received block is not the block following the previous block at step 780, this means that the currently received graphic data is the graphic data of a different kind or the graphic data transmitted from another transmitting part, and then it is judged whether any storage region exists in the graphic

data storage section at step 800. If it is judged that there exists a storage region, the graphic data of the newly received SMS block is stored at step 810, while if not, the receiving operation is terminated without storing the corresponding graphic data.

[0063] Meanwhile, the decoding operation of step 770 will be explained in detail with reference to FIGs. 8A and 8B.

[0064] During a decoding mode of the received graphic data at step 770, the graphic data is read out bit by bit at step 771. At step 772, it is judged whether the readout bit is '1' or '0'. If the bit is '0', the value of the '0'-detection count is increased at step 777. At step 778, it is judged whether the block termination code is detected. If the block termination code is detected, the detection operation is terminated, while if not, the operation of step 777 is repeatedly performed. If the bit is '1' at step 772, it is judged whether the value of the '0'-detection count is '0' at step 773. If so, the bit '1' read out at step 773 is stored, as it is at step 774, and the operation of step 771 is repeatedly performed. If it is judged that the value of the '0'-detection count is not '0', the bit '0' of the original graphic data is produced through the value of the '0'-detection count according to the run length coding at step 775. At step 776, the bit '0' produced at step 775 is stored as it is, and the operation of step 771 is repeatedly performed. As a result, the decoding operation of the data compressed through the run length coding is completed.

[0065] As described above, the present invention provides the advantages that it can transmit and receive a user information having a relatively large amount of data using a typical short message service between digital mobile stations which belong to a radio network. That is, the present invention can perform the mutual transmission and reception of the user information having a large amount of data between originating and terminating mobile stations without constructing a separate device or system for the transmission and reception of the user information.

[0066] Also, the present invention provides the advantages that it can transmit and receive information having a relatively large amount of data such as graphic data and audio data by overcoming the limited condition of the amount of transmitted data that the SMS implemented in the typical mobile station has. This can be effected by providing a new SMS block structure which enables the transmission and reception of the user information having a large amount of data between the mobile terminals, and this SMS block can be processed by the typical SMS block processing method.

[0067] Also, the present invention can provide a data compression method for a digital mobile station, which enables the user information having a large amount of data to be included in the SMS block in transmitting and receiving the user information using the SMS.

Claims

1. A data transmitting apparatus for a digital mobile station comprising:

   a data storage section for storing data to be transmitted;

   an encoding section for reading and encoding stored data in a predetermined form to produce encoded data;

   a data transmission header generating section for generating inherent distinction data transmission headers corresponding to the encoded data;

   a control section for forming user data of the short message service, based on the encoded data and the generated data transmission headers; and

   a short message transmitting section for transmitting the user data of the short message service within short message service blocks.

2. The data transmitting apparatus as claimed in claim 1, wherein the encoding section encodes the readout data by a run length coding.

3. The data transmitting apparatus as claimed in claim 1 or 2, wherein the data transmission header generating section comprises:

   a data header field for distinction of the transmitted data; and
   a transmitted data field allocated with the encoded transmitted data.

4. The data transmitting apparatus as claimed in claim 3, wherein the data header field includes a transmitted data distinction field, a transmitting part distinction field, and a field for distinction of a kind of the transmitted data.

5. The data transmitting apparatus as claimed in claim 3 or 4, wherein the transmitted data field further comprises a field which has a field length predetermined by a system, which is properly allocated with the encoded data corresponding to the field length, and which is allocated with a block termination code for indicating the termination of the allocated encoded data.

6. The data transmitting apparatus as claimed in one of the claims 1 to 5, wherein the control section divides the encoded data into blocks having a proper amount of data, adds the data transmission

headers having different transmission orders to the respective divided blocks, and forming the respective blocks added with the data transmission headers into the user data of the short message service.

7. The data transmitting apparatus as claimed in claim 6, wherein the control section forms the short message blocks by adding the short message service headers to the user data of the short message service.

8. The data transmitting apparatus as claimed in claim 7, wherein the short message service transmitting section sequentially transmits the short message service blocks with reference to transmission orders added to the data transmission headers.

9. A data receiving apparatus for a digital mobile terminal comprising:

a data transmission header detecting and analyzing section for detecting predetermined inherent data transmission headers from received short message service blocks, and analyzing the detected data transmission headers;

a decoding section for decoding the received short message service blocks in a predetermined form according to the detection of the data transmission headers;

a control section for distinctively determining storage regions of the decoded short message service blocks according to a result of analyzing the data transmission headers; and

a data storage section for storing the decoded short message service blocks according to the determined storage regions.

10. The data receiving apparatus as claimed in claim 9, wherein the decoding section decodes the received short message service blocks by a run length decoding.

11. The data receiving apparatus as claimed in claim 9 or 10, wherein the data transmission header detecting section detects from the received short message service blocks code data included in a data header field for distinction of transmitted data and a transmitted data field allocated with encoded transmitted data, and analyzes the detected code data.

12. The data receiving apparatus as claimed in claim 11, wherein the data transmission header detecting and analyzing section detects and analyzes code data included in a transmitted data distinction field, a transmitting part distinction field, a transmitted data kind distinction field, and a transmitted block order field which constitute the data header field.

13. The data receiving apparatus as claimed in claim 11 or 12, wherein the data transmission header detecting and analyzing section detects and analyzes a block termination code which is included in the transmitted data field and which indicates a final data of the received short message service block.

14. The data receiving apparatus as claimed in one of the claims 9 to 13, wherein the control section designates storage orders of the decoded short message service blocks according to an analysis result of the respective data transmission headers included in the respective received short message service blocks, and then determines storage positions of the short message service blocks.

15. A data transmitting method for a digital mobile station using a short message service comprising the steps of:

reading and encoding stored data in a data transmission mode to produce encoded data;

generating inherent distinction data transmission headers corresponding to the encoded data;

forming user data of a short message service, based on the encoded data and the generated data transmission headers; and

transmitting short message service blocks including the user data of the short message service.

16. The data transmitting method as claimed in claim 15, further comprising the steps of:

comparing an amount of the encoded data with that of the readout data; and

selecting the data having a less amount of data as a result of comparison, and forming the selected data and the generated data transmission header into the user data of the short message service.

17. The data transmitting method as claimed in claim 15 or 16, wherein the step of reading and encoding encodes the readout data by a run length coding.

18. The data transmitting method as claimed in one of the claims 15 to 17, wherein the step of generating generates the data transmission header which

includes a transmitted data distinction field for distinction of the transmitted data, a field for a whole number of blocks of the encoded data, a field for a transmission order of the encoded data, a transmitting part distinction field, and a field for distinction of a kind of the transmitted data.

19. The data transmitting method as claimed in one of the claims 15 to 18, further comprising the steps of:

making the encoded data into blocks having a predetermined amount of data if the amount of the encoded data is larger than a predetermined amount of data;
adding inherent data transmission headers and short message service headers to the respective data blocks; and
sequentially transmitting the data blocks in a predetermined order.

20. The data transmitting method as claimed in claim 19, further comprising the step of adding a block termination code which indicates a final data of the block to the respective data block.

21. The data transmitting method as claimed in claim 19 or 20, further comprising the step of sequentially transmitting the blocks with reference to the field for the transmission order of the encoded data.

22. The data transmitting method as claimed in one of the claims 19 to 21, further comprising the step of displaying a state of the blocks sequentially transmitted with reference to the generated inherent transmission headers.

23. A data receiving method for a digital mobile station using a short message service comprising the steps of:

detecting whether short message service blocks are received in a standby state;
determining whether the detected short message service blocks include predetermined inherent distinction data transmission headers if it is detected that the short message service blocks are received in the standby state;
analysing the data transmission headers and then decoding the received short message service blocks according to a result of analysis if it is determined that the detected short message service blocks include data transmission headers; and
storing the decoded short message service blocks in succession to previously processed short message service blocks.

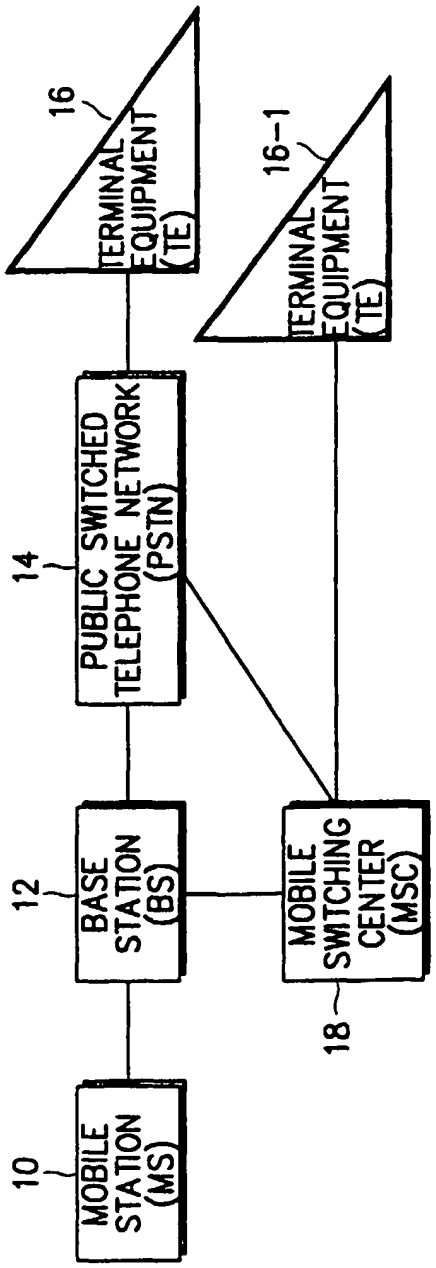
24. The data receiving method as claimed in claim 23, wherein the step of determining determines whether a transmitted data distinction code for distinction of the transmitted data is included in the distinction data transmission header.

25. The data receiving method as claimed in claim 23 or 24, wherein the step of analyzing is performed by detecting and analyzing a transmitted data distinction code for distinction of the transmitted data, a code for a whole number of blocks of the encoded data, a code for a transmission order of the encoded data, a transmitting part distinction field, and a field for distinction of a kind of the transmitted data.

26. The data receiving method as claimed in one of the claims 23 to 25, wherein the decoding step is performed by a run length decoding.

27. The data receiving method as claimed in one of the claims 23 to 26, further comprising the step of storing the decoded short message service block in a different storage region from that of the previously processed and stored short message service block.

FIG. 1


16
TERMINAL EQUIPMENT (TE)
16-1
TERMINAL EQUIPMENT (TE)
14
PUBLIC SWITCHED TELEPHONE NETWORK (PSTN)
12
BASE STATION (BS)
MOBILE SWITCHING CENTER (MSC)
18
10
MOBILE STATION (MS)

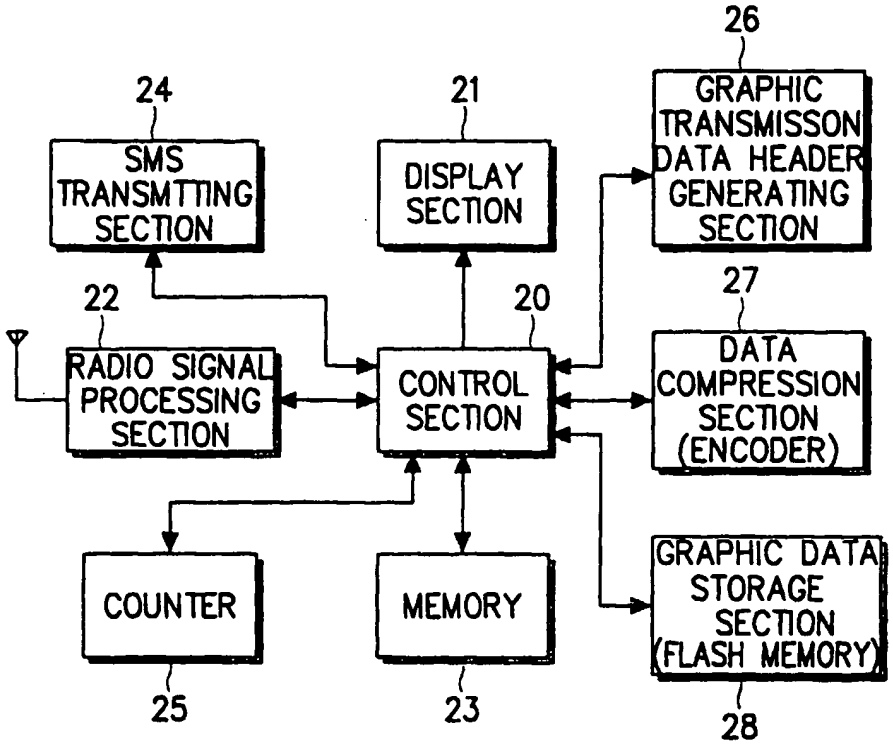

26
24
21
GRAPHIC TRANSMISSON DATA HEADER GENERATING SECTION
SMS TRANSMTTING SECTION
DISPLAY SECTION
22
20
27
RADIO SIGNAL PROCESSING SECTION
CONTROL SECTION
DATA COMPRESSION SECTION (ENCODER)
COUNTER
MEMORY
GRAPHIC DATA STORAGE SECTION (FLASH MEMORY)
25
23
28

FIG. 2

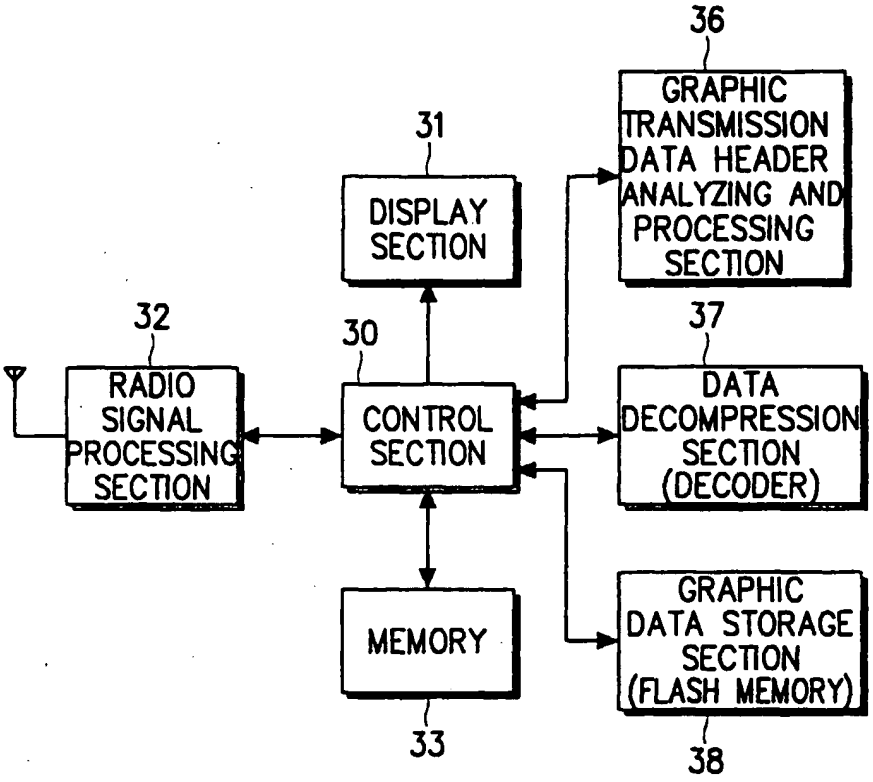
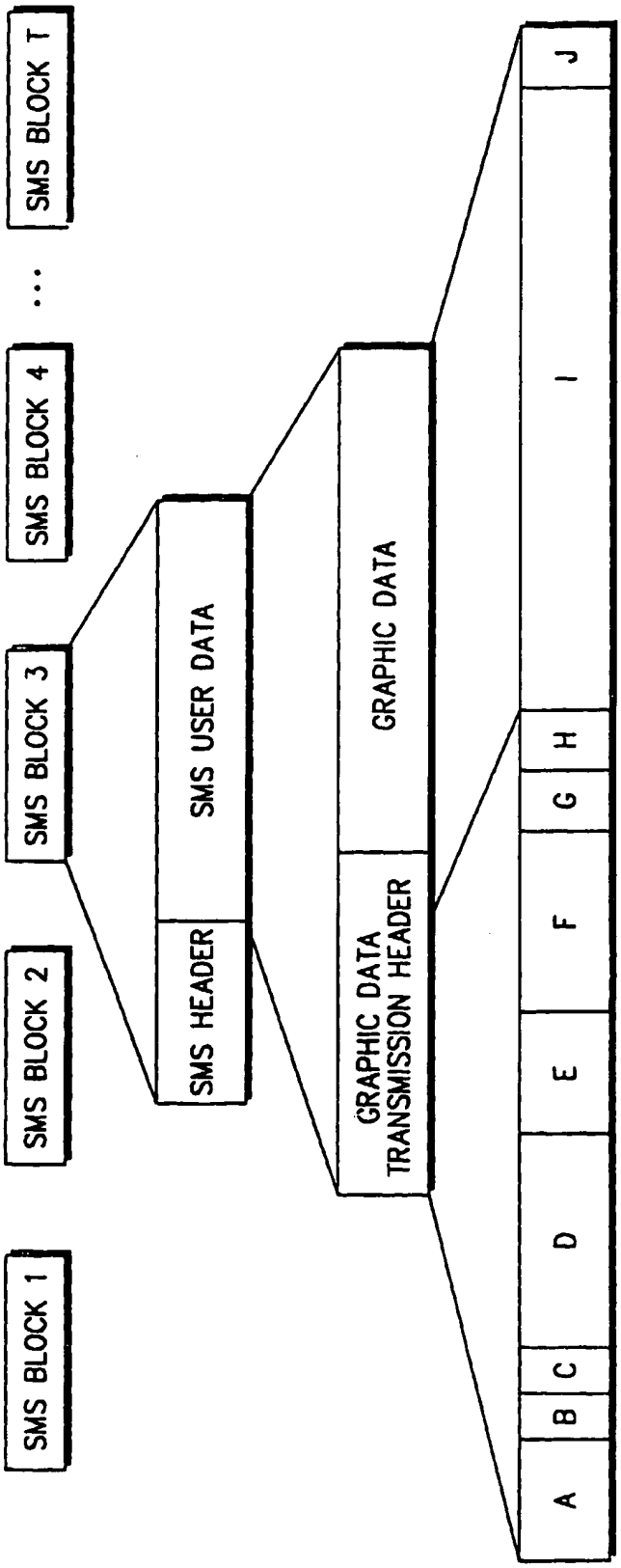

36
GRAPHIC TRANSMISSION DATA HEADER ANALYZING AND PROCESSING SECTION
31
DISPLAY SECTION
32
30
37
RADIO SIGNAL PROCESSING SECTION
CONTROL SECTION
DATA DECOMPRESSION SECTION (DECODER)
MEMORY
GRAPHIC DATA STORAGE SECTION (FLASH MEMORY)
33
38

FIG. 3

FIG. 4



A(2byte); GRAPHIC DATA DISTINCTION CODE
B(4bit); THE TOTAL NUMBER (T) OF TRANSMITTED BLOCKS
C(4bit); THE ORDER (I) OF TRANSMITTED BLOCKS
D(4byte); TRANSMITTING PART DISTINCTION CODE
E(2byte); CODE FOR THE KIND OF GRAPHIC DATA
F(3byte); EXTENSION CODE
G(1byte); CODING TYPE DISTINCTION CODE
H(1byte); EXTENSION CODE
I(nbyte); GRAPHIC DATA
J(6bit); BLOCK TERMINATION CODE

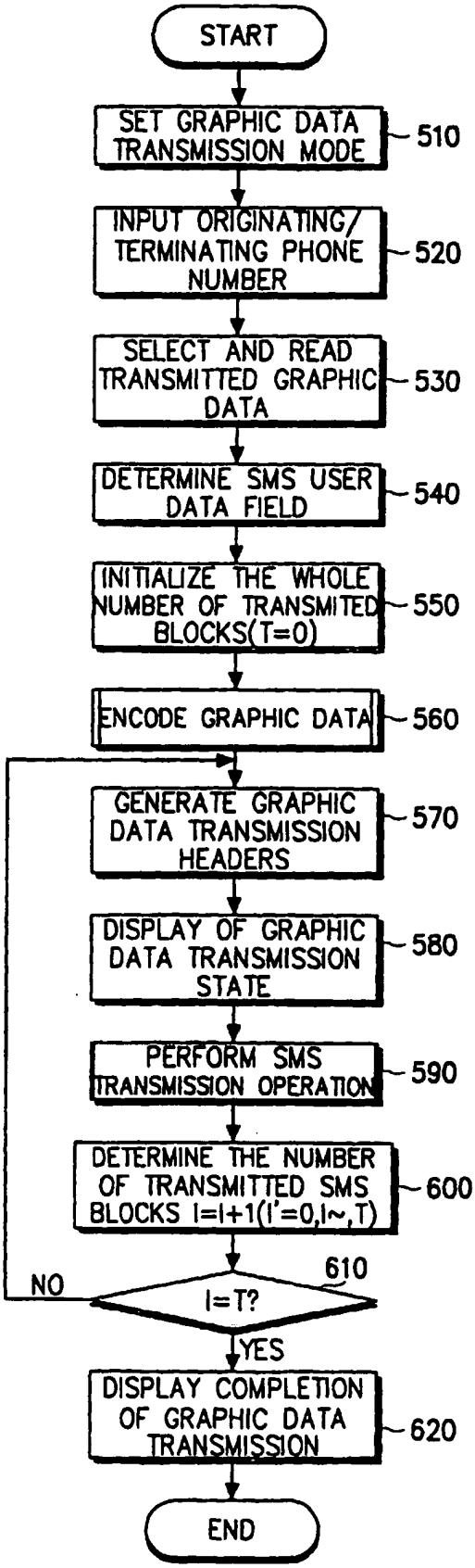


FIG. 5

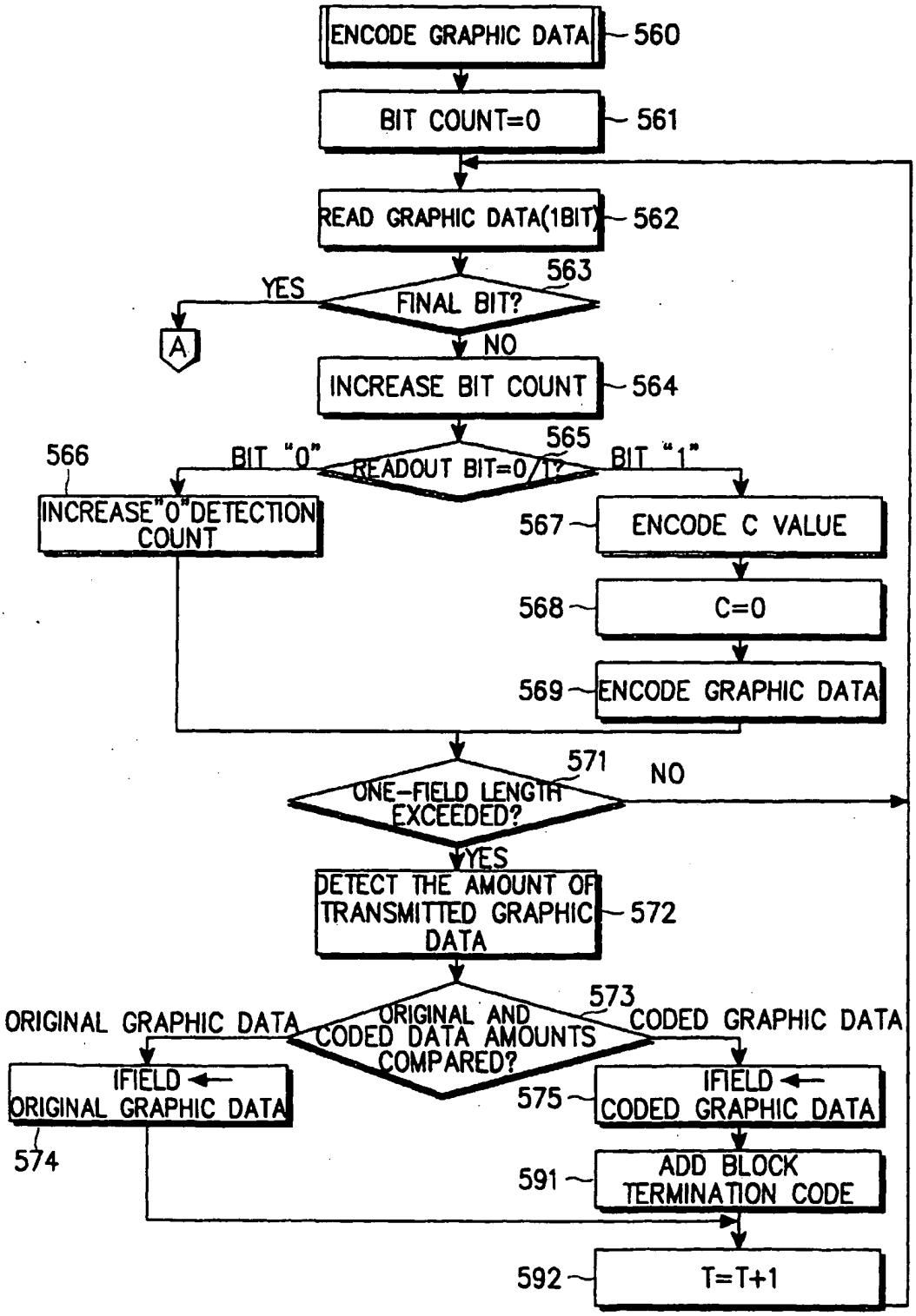

ENCODE GRAPHIC DATA
560
BIT COUNT=0
561
READ GRAPHIC DATA(1BIT)
562
563
YES
FINAL BIT?
A
NO
INCREASE BIT COUNT
564
565
566
BIT "0"
READOUT BIT=0/1?
BIT "1"
INCREASE "0" DETECTION COUNT
567
ENCODE C VALUE
568
C=0
569
ENCODE GRAPHIC DATA
571
NO
ONE-FIELD LENGTH EXCEEDED?
YES
DETECT THE AMOUNT OF TRANSMITTED GRAPHIC DATA
572
573
ORIGINAL GRAPHIC DATA
ORIGINAL AND CODED DATA AMOUNTS COMPARED?
CODED GRAPHIC DATA
IFIELD ← ORIGINAL GRAPHIC DATA
574
575
IFIELD ← CODED GRAPHIC DATA
591
ADD BLOCK TERMINATION CODE
592
T=T+1

FIG. 6A

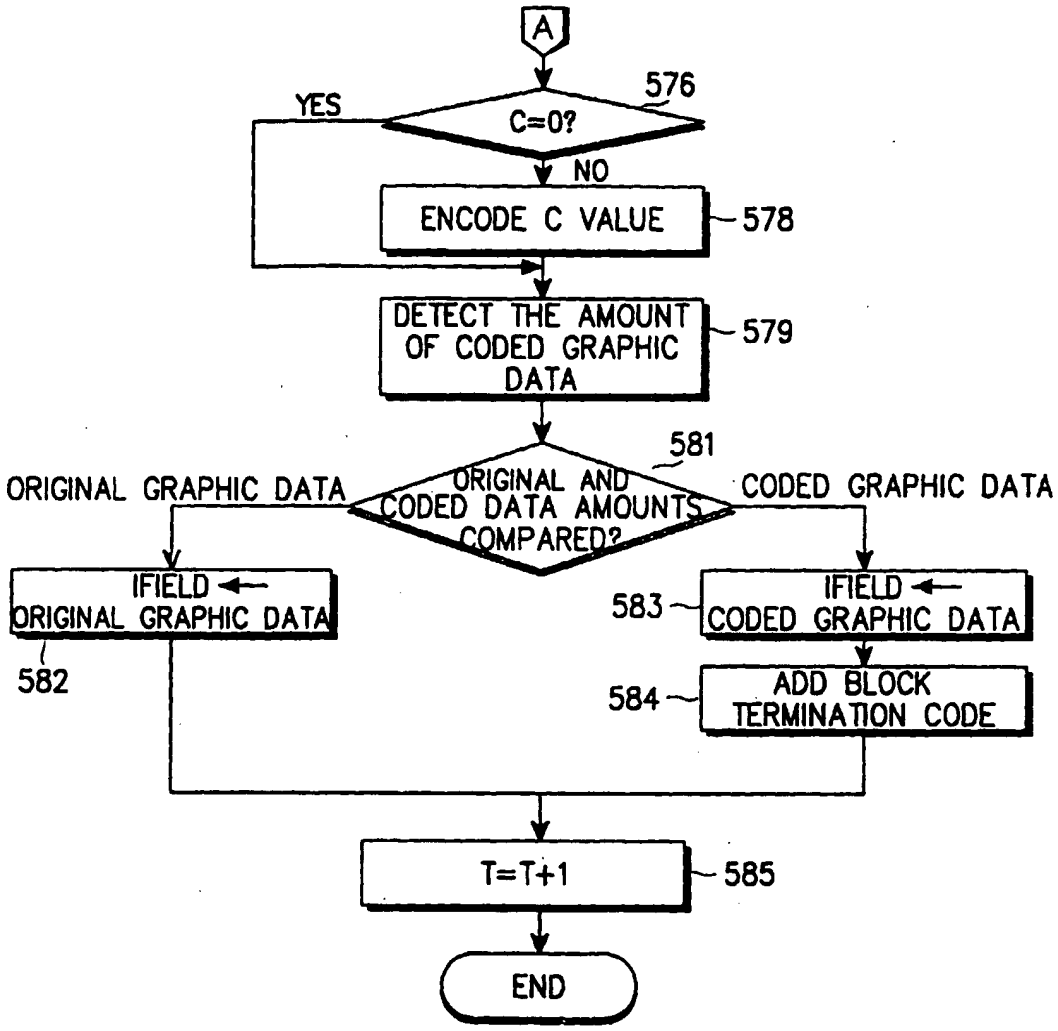

A
576
YES
C=0?
NO
ENCODE C VALUE
578
DETECT THE AMOUNT OF CODED GRAPHIC DATA
579
581
ORIGINAL GRAPHIC DATA
ORIGINAL AND CODED DATA AMOUNTS COMPARED?
CODED GRAPHIC DATA
IFIELD ← ORIGINAL GRAPHIC DATA
582
583
IFIELD ← CODED GRAPHIC DATA
584
ADD BLOCK TERMINATION CODE
T=T+1
585
END

FIG. 6B

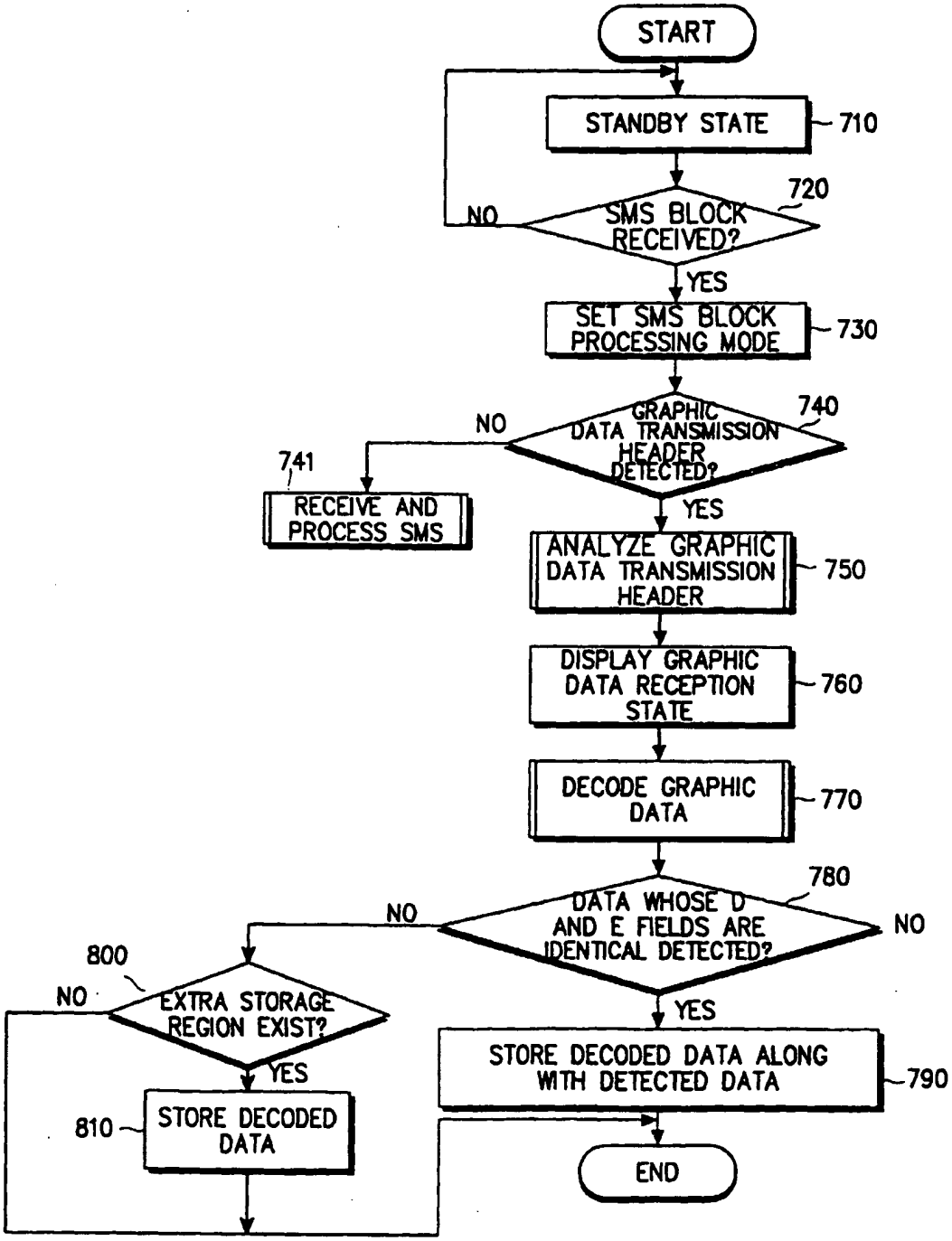

START
STANDBY STATE
710
SMS BLOCK RECEIVED?
720
NO
YES
SET SMS BLOCK PROCESSING MODE
730
GRAPHIC DATA TRANSMISSION HEADER DETECTED?
740
NO
741
RECEIVE AND PROCESS SMS
YES
ANALYZE GRAPHIC DATA TRANSMISSION HEADER
750
DISPLAY GRAPHIC DATA RECEPTION STATE
760
DECODE GRAPHIC DATA
770
DATA WHOSE D AND E FIELDS ARE IDENTICAL DETECTED?
780
NO
NO
YES
800
EXTRA STORAGE REGION EXIST?
NO
YES
810
STORE DECODED DATA
STORE DECODED DATA ALONG WITH DETECTED DATA
790
END

FIG. 7

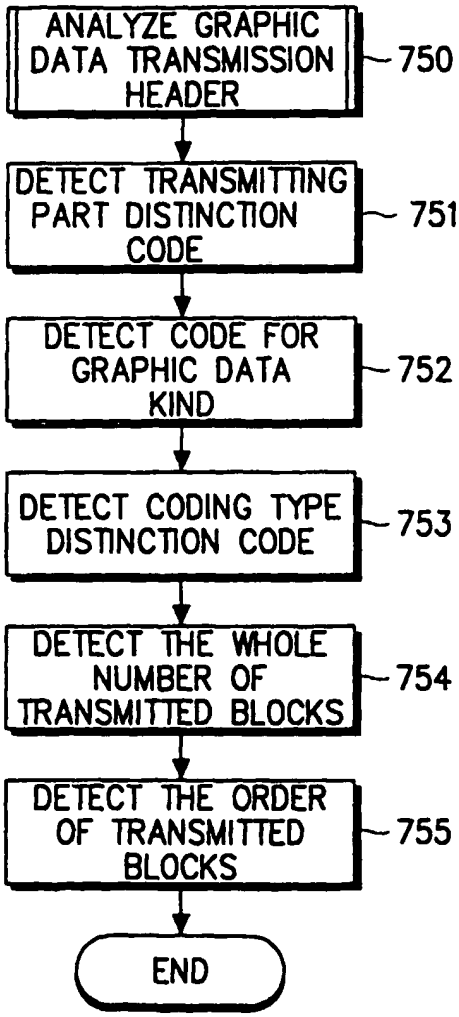

ANALYZE GRAPHIC DATA TRANSMISSION HEADER
750
DETECT TRANSMITTING PART DISTINCTION CODE
751
DETECT CODE FOR GRAPHIC DATA KIND
752
DETECT CODING TYPE DISTINCTION CODE
753
DETECT THE WHOLE NUMBER OF TRANSMITTED BLOCKS
754
DETECT THE ORDER OF TRANSMITTED BLOCKS
755
END

FIG. 8A

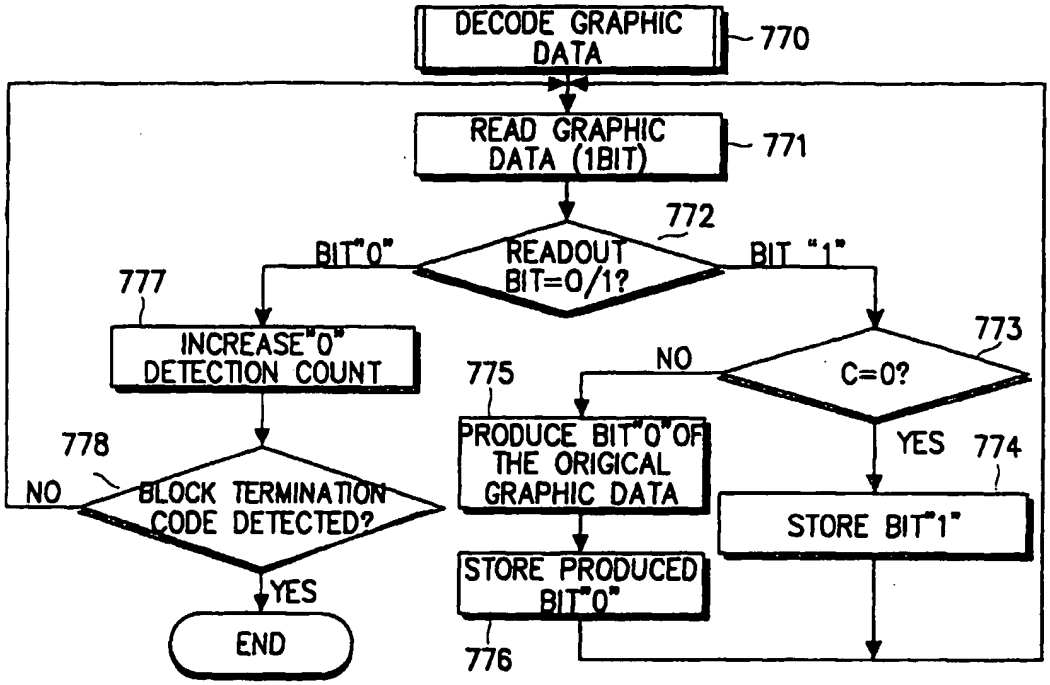

DECODE GRAPHIC DATA
770
READ GRAPHIC DATA (1BIT)
771
772
READOUT BIT=0/1?
BIT"0"
BIT "1"
777
INCREASE"0" DETECTION COUNT
773
C=0?
NO
775
YES
774
PRODUCE BIT"0"OF THE ORIGICAL GRAPHIC DATA
STORE BIT"1"
778
NO
BLOCK TERMINATION CODE DETECTED?
YES
STORE PRODUCED BIT"0"
END
776

FIG. 8B

FIG. 9A

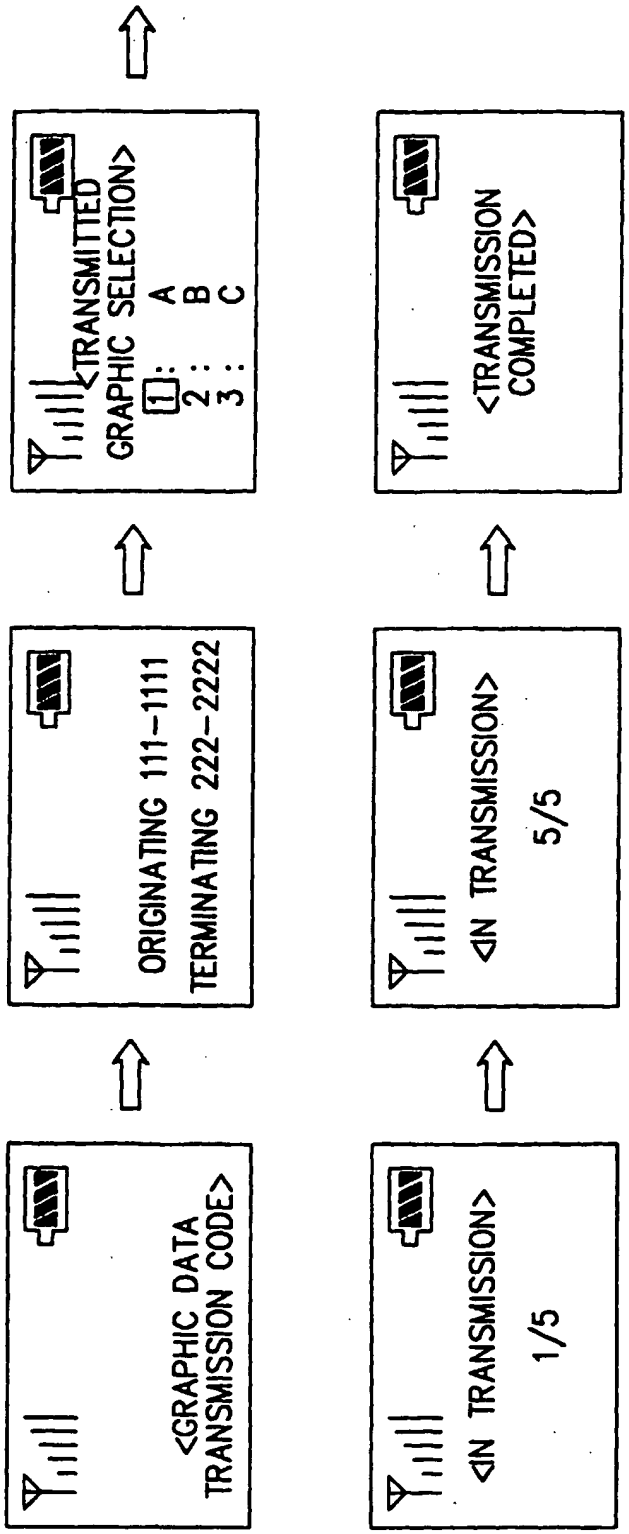
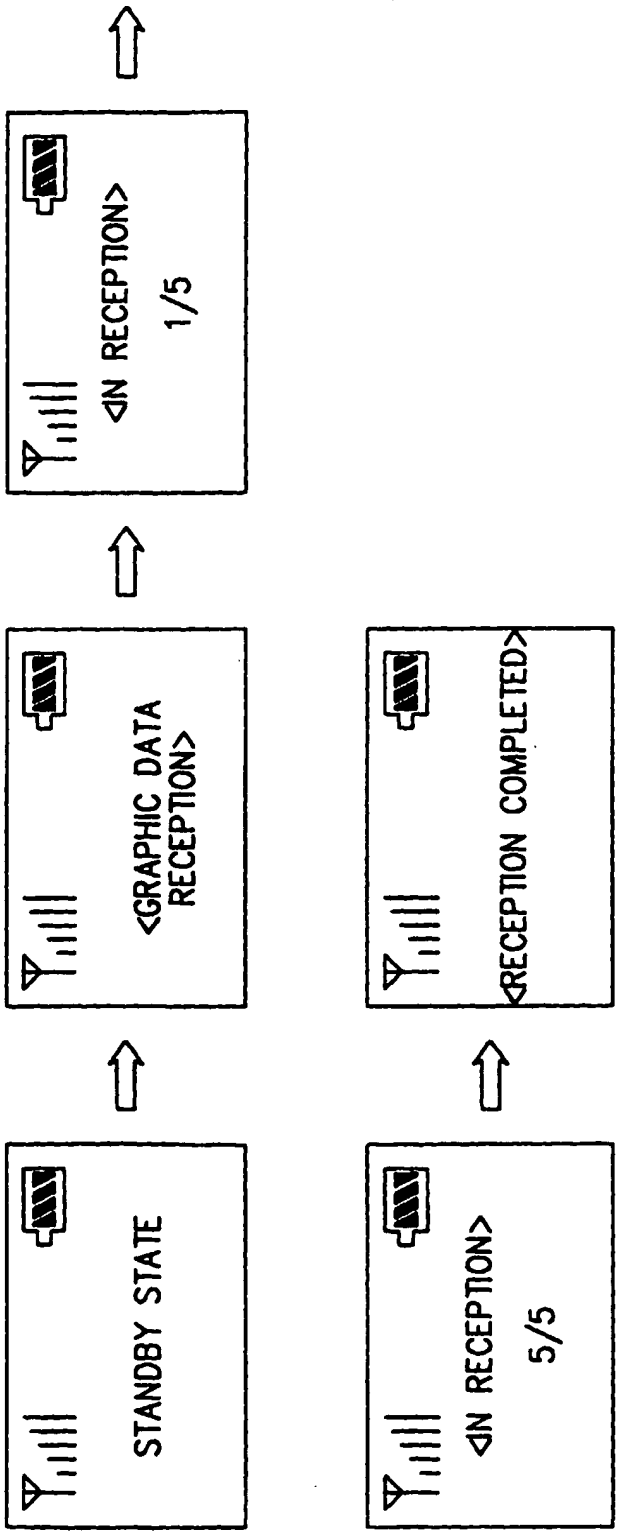

<GRAPHIC DATA TRANSMISSION CODE>
ORIGINATING 111-1111
TERMINATING 222-2222
<TRANSMITTED GRAPHIC SELECTION>
1: A
2: B
3: C
<N TRANSMISSION>
1/5
<N TRANSMISSION>
5/5
<TRANSMISSION COMPLETED>

FIG. 9B


STANDBY STATE
<GRAPHIC DATA RECEPTION>
<N RECEPTION> 1/5
<N RECEPTION> 5/5
<RECEPTION COMPLETED>